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A CONTRIBUTION TO THE MAMMALOGY OF NORTHERN NEW JERSEY.

BY SAMUEL N. RHOADS.

The following notes on New Jersey mammals are based on personal experience had during three collecting trips in the northern portion of the State. In some cases I have added to my own observations those of people living in the localities named, whose testimony was considered thoroughly reliable.

Trip number one was made during the last week in May, 1893, to Nolan's Point, Lake Hopatcong, Morris County, collecting being confined within a radius of three miles from Nolan's Point Villa, on the east shore of the lake.

The second trip included a brief stay of five days during the last week in August, 1893, at a place near Delaware Gap station in the western corner of Warren County. Trapping was restricted to a line of woodland and meadow connecting a lake (Sunfish Pond) 2 miles distant, with the farm-house in which I lodged near Delaware Gap.

The third and most important trip covered a period of three weeks, extending from the sixth to the thirtieth days of October, 1896. It included three stops of one week each ; the first at Culver's Lake, Sussex County, the second at Unionville, Orange County, New York, just across the northern boundary of Sussex County near the Walkill Valley, and the third at the southern end of Greenwood Lake in Passaic County.

Considered in their faunal, geological and topographic relations, there is a great similarity in all the localities named, lying as they do within the Alleghenian life region, as restricted by Dr. J. A. Allen, and moulded by the powerful agencies of the glacial period which has left its characteristic impress upon the greater part of northern New Jersey. The mountains of Warren, Sussex and Passaic Counties are the highest on the eastern side of the Delaware River, several attaining the height of nearly 1,900 feet. The Kittatinny Range, in its continuation northward from the Water Gap, runs close to two stations named in the above itinerary, viz., Delaware Gap on the western slope and Culver's Lake (Culver's Gap) on the eastern. The mountain at these places is covered mainly with deciduous trees, alternating with pines and occasional hemlock in swampy localities, isolated bogs of tamarack and rhododendron and fir affording retreat for animals more characteristic of the Canadian fauna.

The lakes of New Jersey are numerous; Culver's Lake and Long Lake together cover a considerable tract, and with their surroundings of swamp and mountain form a natural forest game preserve that is well worth the future attention of the legislators of the State. At Lake Hopatcong, the largest of all, the country is less mountainous, and the fauna and flora shade somewhat into the Carolinian elements, but at Greenwood Lake the western range of Greenwood Mountain shows the most marked Canadian features noted in the State, frequent swamps and bogs of white cedar, fir, pine, hemlock and tamarack nestling among the depressions of the summits.

The excursions of which the following pages form a summary are part of the author's plan to make a comprehensive zoological survey of all the counties of New Jersey and Pennsylvania, with special reference to mammalogy and herpetology. About half of this labor has been completed.

1. **Didelphis marsupialis virginiana** (Kerr). Virginia Opossum.

No specimens of opossum were taken. Its rare occurrence at Greenwood Lake, where I was informed by the hunters that two had been captured in the last two years, is of interest as showing the presence of this animal in the most boreal surroundings which the State affords.

An examination of the large opossums of North and South America which belong to the *marsupialis* type of Linnæus, shows a specific difference in the character of the last premolar. In Brazilian and Surinam specimens this tooth is a retrorse, blunt, rounded cone with slight trace of a shoulder above the cingulum on the posterior border. In examples from the eastern United States and Mexico the tooth is sharply and abruptly conical, compressed laterally and entirely surrounded by a tuberculate basal shoulder. Independently of other marked characters, this is sufficient at once to divide specifically the composite group *marsupialis* as defined by Oldfield Thomas[1] into two sections. A study of Linnæus' description[2] leads me to adopt Hernandez's Mexican animal as the least composite type of *marsupialis* with definite given habitat. *D. karkinophaga*

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[1] Cat. Marsup. Monot. B. Mus., 1888, pp. 323-327.

[2] Syst. Nat., 1758, p. 54.

Zimmerman[3] is the first name given to the South American species from Cayenne; *D. aurita* Max. Wied[4] (=*D. azaræ* Temm.) becoming under the ruling of Thomas (lc.), *D. karkinophaga aurita* (Max. Wied).

2. **Dorcelaphus virginianus** (Bodd.). Virginia Deer.

It has been many years since one of these animals was killed in any of the localities visited. Several are confined in a game preserve surrounding Sunfish Pond in Warren County, and a few in the Dalrymple preserve on the east side of Long Lake in Sussex County.

3. ? **Cervus canadensis** (Erxl.). Wapiti.

A hunter near Delaware Gap declared that his grandfather, who "killed the last Elk shot in Pike County," Pennsylvania, stated that sometimes the hounds would drive both elk and deer across the Delaware River onto the Kittatinny Mountain. That the latter species has quite recently been known to find temporary refuge in Sussex County on this account is easily proved, and it is probable that in this manner the Wapiti has either voluntarily or involuntarily become a member of the New Jersey fauna within the present century.

4. **Lepus americanus** Erxl. Varying Hare.

Once pretty numerous in the tamarack swamps of northern New Jersey, this species now seems to be exterminated. Mr. Larkin Hazen stated that he shot one about six winters ago on Greenwood Mountain just across the State line in Orange County, New York. They used to frequent a small swamp near Culver's Gap, but I was unable to find any trace of them there.

5. **Lepus sylvaticus** Bachm. Wood Hare.

No specimens of this common species were secured. On this account I am unable to say whether the subspecies *transitionalis* is found in northern New Jersey.

6. **Synaptomys cooperi** Baird. Cooper's Vole.

Four specimens of Cooper's Vole were secured. The first, an adult male, was trapped in a wet meadow close to woodland among sphagnum and tussocks of *Juncus*; and the second, an adult nursing female, under a heap of stones along the edge of dry wood-land but quite near swampy ground. Both these specimens were caught near the head of Long Lake, adjoining Bear Swamp, October 8th and 15th, 1896. Two additional examples were trapped October 29th at Greenwood Lake, the first in a wet pasture lot at the south end of the lake, the last along a deep ravine in Greenwood Mountain, among sphagnum and grass by the road-side.

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[3] Geog. Gesch., 1870, p. 226.

[4] Beitr. Nat. Bras., 1826, p. 395.

In no case have I seen this species out of easy reach of sphagnum or removed a stone's throw from woodland, even when wet meadows afforded it a tempting diversion into open country.

The specimens are esentially like those of this species taken in Pennsylvania and New England, being uniformly lighter colored than those found in the bogs of southern New Jersey at the same season, to which I gave the name *Synaptomys stonei* in 1893, and which a full series of specimens is likely to prove separable from *cooperi* as a subspecies.

I believe the above record of typical *cooperi* is the first for New Jersey, though it is probable that Cooper's original specimen was taken in the northern section of the State.

7. **Microtus pennsylvanicus** (Ord). Wilson's Meadow Vole.

As was expected, the common meadow mouse proved very abundant in all visited localities.

Of the ninety specimens taken, none show any remarkable variation from the typical form found in southeastern Pennsylvania. Several females contained embryos, while young of all stages of growth were secured. It is not likely that the severest winter weather puts any effectual period to the reproductive powers of this animal. In old nursing females the fall moult seemed to be sometimes almost wholly arrested, their pelage presenting a very ragged and faded appearance.

8. **Microtus pinetorum** (LeC.). Pine-woods Vole.

Comparison of two specimens of this vole taken at Delaware Gap shows no differences of even subspecific value to separate them from individuals taken in the pine barrens of southern New Jersey. Unless South Carolina and Georgia specimens differ markedly from any I have yet taken in Pennsylvania and New Jersey, the conclusion of Audubon and Bachman, that *scalopsoides* is a synonym of *pinetorum*, holds good.

The individual and seasonal variations in this species among specimens from the same locality are very great, making it necessary that a large suite of skins from Florida to Massachusetts be consulted to determine this point. In any event, all the Pine Voles of Pennsylvania and New Jersey belong more properly to the northern type.

No specimens were taken except at Delaware Gap.

9. **Evotomys gapperi** (Vigors). Gapper's Wood Vole.

Thirteen specimens were trapped in and about Bear Swamp near Long Lake, and six more in a hemlock swamp in the bottoms of the Walkill about two miles south of the New York State line. They are similar to specimens from Quebec, being lighter colored than those taken by Mr. Stone at May's Landing, New Jersey, in 1893.

I am convinced that the reason this species was not taken near Greenwood Lake, was my neglect to set traps in the more retired and deep-shaded hemlock swamps.

10. **Fiber zibethicus** (L.). Muskrat.

No specimens of this abundant species were taken, except at Lake Hopatcong.

11. **Peromyscus leucopus** (Raf.). Deer Mouse.

A large series of deer mice from every locality mentioned in the itinerary of this paper closely conform in character to those of other parts of New Jersey and Pennsylvania. Though abundant in localities where *Evotomys* was found, no specimens of *P. canadensis* were secured among them, showing that the mountains of northern New Jersey lack the more typical Canadian elements which are found in isolated places in Pennsylvania where I have taken *canadensis.*

There is a marked racial difference between *leucopus* of Pennsylvania and New Jersey and the type of *leucopus* found in Massachusetts and northern New York, the latter being smaller and brighter colored with a narrower dark dorsal stripe and more hairy tail. Pennsylvania and New Jersey specimens are practically identical with those collected by me in west Tennessee and Kentucky, where the type form of *leucopus* defined by Rafinesque is found. It has been proved by Mr. G. S. Miller, Jr.,[5] that the *Cricetus myodes* of Gapper applies to the smaller short-tailed deer mouse of Canada which is apparently identical with those of northern New York and New England. These facts induce me to revive the name *myodes* for the small deer mouse of the eastern Canadian fauna, making it read *Peromyscus leucopus myodes* (Gapper).

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[5] Proc. Biol. Soc. Wash., 1893, pp. 59, 60.

12. Neotoma magister Baird. Allegheny Cave Rat.

The occurrence of this rat in the Hudson highlands near New Jersey, and in Massachusetts also, has for some years led mammalogists to believe that its distribution across the intervening country would be found continuous in favorable localities. Save the discovery of their remains in the cave deposits of Monroe County, Pennsylvania, there has been no definite record to my knowledge which would connect their habitat in the Allegheny Mountains with that on the Hudson River. I was informed, however, by a hunter at Delaware Gap, that he knew of such an animal on the Kittatinny Mountain in Warren County. This statement I was unable to verify, owing to my short stay at that place. It is very likely that this rat will also be found on the Kittatinny range near Culver's Gap, but during my visit no exploration of the summits was made.

Soon after my arrival at Greenwood Lake, I was told by a local sportsman that he had once caught a "wood rat" on the mountain in a deadfall set for skunks. The summits of Greenwood Mountain at the south end of the lake are made up exclusively of great masses of glaciated conglomerate and shale with perpendicular fissures and steep faults running parallel with the northeast and southwest trend of the range. Chestnut and scrub oaks and dwarfed pines and hemlocks sparingly cover the nakedness of this desolate but picturesque locality. Owing to their perpendicular cleavage, I found the rocks rarely afforded the proper shelter for the abode of the cliff rat, and it was only after nearly two days of climbing that I stumbled upon an escarpment from which the rock masses had so fallen into the gorge as to form a roof. Beneath this, unmistakable signs of the rats were found, and in the two following days an adult male, a very old female and a young male, about two-thirds grown, were secured. These specimens differ in no respects from a series from the Pennsylvania Alleghenies taken at the same season. They form the first New Jersey record of this interesting native rat.

13. Mus decumanus Pallas. Norway Rat.

14. Mus musculus L. House Mouse.

Specimens of the House mouse were taken. Of the status of the Black Rat, *M. rattus*, no notes were secured.

15. Zapus hudsonius (Zimm.). Meadow Jumping Mouse.

Ten specimens from Lake Hopatcong and three from near Culver's Lake represent this animal. The latter were taken in a wet swamp grown up with *Juncus* and grasses. The temperature fell on two nights when these were taken to near 32°, forming heavy frosts. Their absence from my traps in the Walkill Valley and at Greenwood Lake was undoubtedly due to the low temperature having driven them all to their winter repose. A thick layer of yellow fat completely covered the bodies of these Culver's Lake specimens, adhering so firmly to the skin that it was very difficult to preserve the specimens.

16. **Zapus insignis** Miller. Woodland Jumping Mouse.

I secured four beautiful specimens of this *Zapus* in woodland along a small rocky stream connecting a rhododendron swamp with Lake Hopatcong, near Nolan's Point. All were trapped close by the water's edge, precisely as described by Mr. Miller in his later account of the species. I have never taken this animal in open situations such as are preferred by its kinsman of the meadow. The most persistent trapping in likely places at Culver's and Greenwood Lakes did not reveal the presence of *insignis* there. It seems probable that it is more sensitive to frost than *hudsonius* and had gone into winter quarters before my arrival at Culver's Lake. At Greenwood Lake a dormant jumping mouse, evidently of this species from the description given me by the finder, was dug out of a gravel bank during my stay. I visited the spot, and from its situation in deep woodland near a brook, I am morally sure it was *insignis*. The narrator of the incident stated that he knew the meadow species very well, but that this one was "much redder." These particulars are given to show not only that *insignis* is found in Passaic County, but to prove that it hibernates earlier than *hudsonius*.

The presence of a persistent premolar in all other known species of the genus as contrasted with its absence in *Zapus insignis* may eventually entitle the latter to separate subgeneric rank.

17. **Castor canadensis** Kuhl. American Beaver.

Numerous localities in northern New Jersey are pointed out as the traditional sites of beaver colonies. This animal was so early exterminated in these places that I found it impossible to secure any data relating to the time of their extinction.

18. **Arctomys monax** (L.). Woodchuck; Ground Hog.

Very abundant on the Delaware slope of the Kittatinny Mountain; less so in other localities named except at Lake Hopatcong. No specimens were taken.

It seems strange that the unmistakable difference in size and color obtaining between the woodchucks of the Hudson Bay regions and those of Maryland, the type locality of *monax*, should not have been officially recognized. With Dr. Allen's excellent analysis of its nomenclature[6] as a basis, I see no objection to designating the woodchucks of eastern North America by the following formulæ:—

1. *Arctomys monax* (Linnæus), Syst. Nat., 1758, p. 60; Maryland Marmot. Size small; color gray-brown, feet brown. Habitat.—Carolinian fauna, intergrading northward through the Alleghenian and Canadian fauna into

2. *Arctomys monax melanopus* (Kuhl), Beitrage, 1820, p. 64; Hudson Bay Marmot. Size large; color brown-black, feet black. Habitat.—Hudsonian fauna, intergrading southward with typical *monax*.

19. **Tamias striatus** (L.). Carolina Chipmunk.

Forty specimens, representing every locality visited, show nearer affinities to the Carolinian than the Canadian form of our eastern chipmunk. Those from Delaware Gap are scarcely separable from southern New Jersey examples, the Greenwood Lake series being nearest to *lysteri* of Maine, but much darker. This animal is very abundant in Warren, Sussex and Passaic Counties, but not so numerous at Lake Hopatcong.

A temperature of 28° during my stay at Greenwood Lake did not wholly silence them, though it greatly lessened their activity and apparent numbers. Contrary to what I expected, no really fat specimens were procured, and all seemed most busily intent on gathering and storing acorns at a season when they are generally supposed to go into their winter sleep. About twenty per cent of those taken had the tail shortened or injured in some manner.

20. **Sciurus hudsonicus loquax** Bangs. Carolinian Chickaree.

Numerous everywhere; abundant in the deeper evergreen forests.

21. **Sciurus carolinensis pennsylvanicus** (Ord). Northern Gray Squirrel.

Not common except in the vicinity of Long Lake.

Even the former existence of the Fox Squirrel in northern New Jersey rests on such unreliable evidence that I am unwilling to include it in this paper.

Monog. N. A. Rod., 1877, pp. 915–917.

22. **Sciuropterus volans** (L.). Carolinian Flying Squirrel.

A female and three young taken at Lake Hopatcong, and a male from near Culver's Lake, show no tendency to gradation with the northern animal.

23. **Procyon lotor** (L.). Raccoon.

Not rare. A special object of sport among the natives of Greenwood Lake.

24. **Lutra hudsonica** Lacép. Canadian Otter.

The otter continues to exist in all the more secluded bodies of water in the counties under consideration. Specimens had been taken at Hopatcong, Culver's and Greenwood Lakes within a year of my visits to these places.

25. **Putorius vison lutreocephalus** (Harlan). Southeastern Mink.

None of this species were seen. The hunters everywhere reported them scarce.

26. **Putorius noveboracensis** Emmons. Carolina Weasel.

Not common and rarely becoming white in winter, even at Greenwood Lake.

27. **Mephitis mephitica** (Shaw). Northern Skunk.

Not having specimens, I am induced to include the skunks of northern New Jersey under the above name, solely on geographical grounds. They are fairly abundant in the region.

28. **Ursus americanus** Pallas. American Black Bear.

No bears were reported to me as still existing in the localities visited. The recent killing of bears at Port Jervis, makes it possible that they occasionally wander into the northwestern corner of Sussex County.

29. **Urocyon cinereoargenteus** (Müll.). Northern Gray Fox.

Reported to be rare by hunters. Outnumbering the red species at Lake Hopatcong.

30. **Vulpes pennsylvanicus** (Bodd.). American Red Fox.

Numerous in the rocky, mountainous districts.

31. **Canis nubilus** Say. American Timber Wolf.

This destructive animal was exterminated in northern New Jersey so long ago that I could obtain no definite data of its disappearance.

32. **Lynx ruffus** (Gueldenstaedt).[7] Eastern Bay Lynx.

Not yet exterminated in Sussex and Passaic Counties, but very rarely taken.

I have been unable to get any record of the Canada Lynx for this region, though it probably wandered thither in earlier times.

33. **Felis concolor** (L.). Puma.

The same remarks which I have previously made regarding the wolf are applicable to this animal.

34. **Scalops aquaticus** (L.). Carolinian Mole.

Not rare in suitable localities. None were secured.

35. **Condylura cristata** (L.). Star-nose Mole.

An old female and four nearly mature young were taken in the same trap on successive days in the underground passage-ways of a spring near Nolan's Point, Lake Hopatcong. The wrist and forearms of the female are encircled by a clear buffy band. The throat, breast and median abdominal line are suffused with dark orange.

36. **Blarina brevicauda** (Say). Northern Mole Shrew.

This *Blarina* is exceedingly abundant in all sorts of situations. In Sussex and Passaic Counties it approaches closely in size to the Canadian specimens.

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[7] The Academy of Natural Sciences of Philadelphia having recently come into possession of the series of "*Novi Commentarii*" of the Imperial Academy of Sciences of St. Petersburg, I am enabled to consult for the first time the reference made by Schreber in Volume 3 of the *Saugthiere*, to the original description of the *Felis ruffa* of Gueldenstaedt.

Schreber's reference on p. 412 of the *Saugthiere* to Gueldenstaedt is faulty. It reads "*Felis rufa* Guldenst., Nov. Comm. Acad. Imp. Sc. Petr., tom 20, p. 499." The specific name *rufa* should be *ruffa*, and Gueldenstaedt's name should have an e in the first syllable. Baird's reference (Mam. N. A., 1857, p. 90) quotes *ruffa* correctly. In common with other writers, Baird may have thought Gueldenstaedt's spelling *ruffa*, a typographic error; in any event he adopted the more modern spelling, *rufus*.

An examination of Gueldenstaedt's article "Chaus Animal Feli Affine Descriptio" in the twentieth volume of the journal referred to, shows that he based his new Lynx solely on the figure and description of the "Bay Cat," species number 136 of Pennants' Synopsis of Quadrupeds. Pennants' references to this animal point unmistakably to the wild cat of "New York" as the type of Gueldenstaedt's *Felis ruffa*. That the latter intended to use the spelling *ruffa* instead of *rufa* can hardly be questioned. as the word is so spelt six times in his paper. An examination of older Latin lexicons shows that this construction of the word is perfectly admissible.

The names of our North American Lynxes of the *ruffus* type may be listed as follows:

1. *Lynx ruffus* (Gueldenstaedt). Eastern Bay Lynx.
2. *Lynx ruffus floridanus* (Rafinesque). Florida Bay Lynx.
3. *Lynx ruffus texensis* (J. A. Allen). Texas Bay Lynx.
4. *Lynx ruffus baileyi* (Merriam). Great Basin Bay Lynx.
5. *Lynx ruffus fasciatus* (Rafinesque). Pacific Bay Lynx.

37. **Sorex personatus** Geoff. St. Hil. Masked Shrew.

A specimen of what I suppose to be this shrew was taken at Delaware Gap.

38. **Sorex fumeus** Miller. Smoky Shrew.

One was taken near Culver's Gap, another near Greenwood Lake. True *Sorex* is apparently a great rarity in northern New Jersey.

39. **Vespertilio lucifugus** LeC. Little Brown Bat.

One specimen was taken at Delaware Gap and several seen at other stations. It is the commonest species in these regions.

40. **Adelonycteris fusca** (Pal. de Beauv.). Greater Brown Bat.

An abundant species.

41. **Atalapha borealis** (Müll.). Red Bat.

Several were noted.